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ABSTRACT

How nursing science researchers conducting mixed method triangulation are using the heterogeneity of irrelevancy assumption in practice was studied. Seven questions were developed to reflect the implications for practice of the heterogeneity assumption. Answers to these questions were obtained from 23 written cases (14 articles, 1 presentation, and 8 dissertations) of mixed method triangulation in nursing science published or conducted during 1980 through 1990. Data were analyzed using techniques from grounded theory. Primary analysis consisted of open coding and constant comparison to develop conceptual labels and more abstract conceptual categories related to each question. A second analysis involving selective coding and constant comparison is incomplete, but was intended to develop the hypothesis regarding the core nature of mixed method triangulation in nursing science. Results suggest that nursing science researchers are practicing a form of triangulation that does not conform to the directives and constraints of the heterogeneity of irrelevancy assumption. The concept of triangulation that they are practicing may be driven more by substantive than methodological concerns. Examples of rationales for method selection, meta-outcomes, and resolutions of divergent results may provide guidelines for practitioners of mixed method triangulation. An appendix lists the five mixed method purposes defined by J. C. Greene and others (1989). There is a list of 46 references. (SLD)

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Mixed Method Triangulation: Theory and Practice Compared

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A working paper presented at the annual meeting of the American Educational Research Association in San Francisco, California, April, 1992.

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Abstract

The primary purpose of this study was to investigate how nursing science researchers conducting mixed method triangulation are using the heterogeneity of irrelevancy assumption in practice. Seven questions were developed to reflect the implications for practice of the heterogeneity of irrelevancy assumption. Answers to the seven questions were obtained from 23 written cases of mixed method triangulation in nursing science.

Data were analyzed using techniques from grounded theory (Strauss & Corbin, 1990). The primary analysis consisted of open coding and constant comparison to develop conceptual labels and more abstract conceptual categories related to each question. A second analysis involving selective coding and constant comparison is incomplete but was intended to develop hypotheses regarding the core nature of mixed method triangulation in nursing science.

Results suggest that nursing science researchers are practicing a form of triangulation that does not conform to the directives and constraints of the heterogeneity of irrelevancy assumption. Rather, researchers in nursing science may be practicing an alternative conception of triangulation that is driven more by substantive rather than methodological concerns. Data based examples of rationales for method selection, meta-outcomes and resolutions of divergent results may provide guidelines for practitioners of mixed method triangulation.

MIXED METHOD TRIANGULATION: THEORY AND PRACTICE COMPARED

* This paper is a working draft of ideas about mixed method triangulation. It is one step in the long process of formulating, clarifying and writing ideas. I would appreciate any suggestions and feedback you have for refining the ideas and for improving their presentation.

Introduction

Researchers and practitioners in the social sciences voice concern over a gap between theory and practice. While the heterogeneity of irrelevancy assumption has received much attention in theoretical discussions of triangulation, it is questionable whether it is relevant to triangulation as practiced. The current investigation was conducted in an effort to help bridge the gap between theory and practice.

Thus, the overriding goal of this investigation was to compare the practice of mixed method triangulation with the theory of mixed method triangulation based on the heterogeneity of irrelevancy assumption. In the process of making this comparison, the primary purpose was to evaluate if and how researchers in nursing science are using the heterogeneity of irrelevancy assumption in their work. A second purpose was to try to develop concepts and categories that were grounded in the particulars of data but abstract enough to be applicable to

disciplines other than nursing science. A third purpose was to develop hypotheses for future research regarding the nature of mixed method triangulation in nursing science.

This investigation builds on the work of many others in the area of mixed method research. However, two references are of particular importance. Greene, Caracelli and Graham (1989) have identified triangulation as one of five purposes of mixed method research. Greene, Caracelli and Graham's five purposes of mixed method research are defined in Appendix A. In her essay, "Why Triangulate?", Mathison (1988) has challenged us to question the applicability of the conventional notion of triangulation based on the heterogeneity of irrelevancy assumption. The focus of this study is on the practice of mixed method triangulation as identified by Greene et al. (1989) in relation to the conventional notion of triangulation as discussed by Mathison (1988).

In literature pertaining to mixed method research, triangulation is commonly associated with the heterogeneity of irrelevancy assumption. This assumption indicates that irrelevant error associated with individual methods can be canceled out in a mixed method triangulation design if methods with counteracting biases are focused on the same entity of investigation and implemented independently. When error is controlled through compensation of inherent biases and different

methods produce the same results, it is often assumed that what is left is more valid findings (Campbell & Fiske, 1959; Collins, 1981; Jick, 1979).

The heterogeneity of irrelevancy assumption has definite implications for the practice of mixed method triangulation. It is questionable whether these implications are applicable to practice and whether researchers are actualizing these implications in practice. The primary purpose of this investigation is to determine if and how nursing science researchers conducting mixed method triangulation seem to address the implications associated with the heterogeneity of irrelevancy assumption in practice. These implications are reflected in the seven research questions that guide this investigation. The research questions are as follows:

1. What kinds of rationales are given for selecting sets of methods with counteracting bias?

2. To what extent are the hypothetical biases of methods preserved by implementing different methods independently?

3. Are researchers assuring that different methods are focused on the same entity of investigation by implementing methods simultaneously or by establishing the stability of the entity over time?

4. What reasons or evidence are given by researchers for believing that questions asked by different methods and information obtained by different methods are comparable?

5. How do researchers justify the expectation of convergence as more valid findings and determine its existence?

6. What kinds of outcomes do actually result from attempts at mixed method triangulation?

7. How is nonconvergence resolved?

Methodology

Mixed method research as an area of investigation is relatively new. Much has been learned about what questions to ask and what benefits to expect from the first hand experience of researchers who have conducted mixed method research. Researchers like Greene, Caracelli and Graham (1989) and Rossman and Wilson (1985, 1991) have compiled and analyzed their own and others' mixed method studies to develop conceptual frameworks for conceptualizing and practicing mixed method research. Research about mixed method research seems to be focused on conceptual understanding and the development of theory. Similarly, the emphasis in this study is on the development of concepts related to mixed method theory while "testing" (conceptually rather than statistically) the applicability of the heterogeneity of irrelevancy assumption to mixed method practice in nursing science.

Grounded theory (Strauss & Corbin, 1990) is a theory building research methodology. It has been selected as the primary methodology in this investigation for several reasons. First, grounded theory is based on the idea that theory should be

developed from the particulars of practice. This is consistent with my belief that theory is important to the development of a discipline, but that for theory to be meaningful and applicable, it needs to be grounded in the "reality" of practice. Second, the "reality" of practice in this investigation is the "written worlds" (articles, dissertations and unpublished papers) of practitioners of mixed method triangulation in nursing science. Grounded theory is useful here because it is so easily applied to documents. Third, grounded theory is devoted to the development of concepts, categories and systems related to a phenomenon. One goal of this investigation is to contribute to the development of theory. While the concepts developed here are based in data from nursing science, it is hoped that the ideas will be abstract enough to be applicable to mixed method research in other disciplines in the social sciences.

Grounded theory is most frequently applied to a global area of study. "What is important" in a general sense is allowed to emerge from the data. However, in this investigation, grounded theory was not applied at such a global level. Rather, the "global" areas of study were focused by seven research questions. Grounded theory was applied to the data collected about the seven research questions. Thus, "what was important" on a global level was predetermined by the seven research questions. "What was important" in the context of each question was allowed to emerge from the data. Furthermore, grounded theory usually involves the

development of concepts, categories and statements of relationships among concepts and categories. In this investigation, data collection and analysis were limited to the development of concepts, categories and hypotheses about possible relationships among concepts and categories.

Data collection. The data base for this investigation consists of 23 cases of mixed method triangulation in nursing science. Cases were purposively selected for inclusion in the study if they consisted of single studies; produced at least two separate data sets; stated an intent to collect, compare and/or combine words and numbers about the same entity of investigation for the purpose of obtaining convergence; and were published or conducted during the years of 1980 through 1990. The sample included 14 articles, 1 presentation and 8 dissertations. Cases were located through word of mouth, citations in literature, hand searches in journals, and computer searches of six different data bases: Dissertation Abstracts, Nurse Search, Medline, Psychlit, ERIC, and Sociofile. Computer search terms included: triangulation, qualitative/ quantitative, mixed method(s), multimethod(s), and multiplism.

In this investigation, mixed method triangulation refers to the process of combining qualitative and quantitative methods focused on the same entity of investigation for the purpose of obtaining convergence of results. As noted by Greene et al. (1989), triangulation may be of primary or secondary importance

in a mixed method study. Both degrees of importance are reflected in the cases selected for this investigation. In 39% of the cases, triangulation seemed to be the primary mixed method purpose in that the design of the study seemed to revolve around the triangulation purpose. In 61% of the cases, triangulation seemed to be a secondary mixed method purpose. In these latter cases, triangulation seemed to be pursued as a strategy in situations where other mixed method purposes (i.e., complementarity, development, initiation, expansion (Greene et al., 1989)) were dominant.

Procedures. An initial set of seven research questions was developed representing implications for practice based on the heterogeneity of irrelevancy assumption. The questions were designed to reveal if and how the conventional theoretical notion of triangulation was being acknowledged and utilized by practitioners. Information pertaining to the seven questions was collected from each written case of mixed method triangulation. The information regarding each question was then grouped together and analyzed as separate categories of information. The primary analysis involved open coding and constant comparison (Strauss & Corbin, 1990) to develop concepts, categories and hypotheses for further research. After the answers to each question were analyzed per question, all information was combined and a second analysis was started. The second analysis involved the use of selective coding and constant comparison (Strauss & Corbin, 1990)

in an attempt to reveal a basic nature of the practice of mixed method triangulation in nursing science, something that might characterize an alternative conception of triangulation. At this point in time, the second 'across-question' analysis is incomplete. Most of the results in this paper are based on the primary 'question-by-question' analysis of the information obtained from cases of mixed method triangulation in nursing science.

Significance. Ideas and hypotheses that are developed in this study of mixed method triangulation in nursing science may be applicable to other disciplines in the social sciences where researchers are investigating attitudes and beliefs of human beings, evaluating the effects of intervention and programs, and developing instrumentation and methodology. Data-based examples of concepts developed in nursing science may provide other researchers in the social sciences with some guidance for practicing triangulation. In addition, the results of this investigation based on data from nursing science may provide mixed method researchers in the social sciences with some reasons to question or accept the utility, implications and conception of triangulation based on the heterogeneity of irrelevancy assumption.

Limitations. This study is based on the written worlds of nursing science researchers. Primary reliance on unobtrusive document analysis in this study precludes confounding of data due

to reactivity and the act of measurement. However, there is less of an opportunity to check the accuracy of written reports and investigate the unwritten motivations of authors.

In this investigation, an attempt has been made to collect and analyze as many cases of mixed method triangulation in nursing science as possible. It is not assumed that all possible cases have been collected. Thus, the data base is subject to revision as are the resulting ideas and hypotheses. Furthermore, the generalizability of results based on nursing science data is limited to the extent that particulars of mixed method practice are differential across disciplines.

The intent of this investigation may best be understood in terms of its delimitations. First, it is not the intent of this study to achieve a level of specificity indicative of logics in use. That level of specificity might best be obtained through the use of interviews. Second, it is not the intent of this investigation to test statistical hypotheses, but rather to explore and develop concepts and "working" hypotheses for further investigation. Third, it is not the intent of this investigation to generate statements of relationships among concepts, although relationships among concepts constitutes an excellent area for further research. Fourth, it is not the intent of this investigation to address or resolve debates regarding mixed method triangulation at a philosophical level. Finally, it is the intent of this investigation to simply produce a data-based

analysis of some issues relevant to the practice of mixed method triangulation in nursing science in the process of comparing theory and practice.

Author's note. One obstacle to the conceptualization and practice of mixed method research may be the qualitative verses quantitative debate in the social sciences. It is now considered appropriate in most educational research circles to combine qualitative and quantitative "techniques and procedures" (Smith & Heshusius, 1986). However, the issue of whether or not "research paradigms" can be combined fuels much of the remaining debate (Howe, 1990).

In spite of this philosophical contention about the infeasibility of combining research paradigms, people are pursuing the fusion and parallel implementation (Louis, 1982) of diverse methods and methodologies. It is assumed by this author that much is to be learned about the theory and practice of mixed method research by studying the written reports of others' attempts at combining methods and methodologies. Perhaps it is by looking at what actually has been done in the way of mixed method research that issues raised in the qualitative-quantitative debate may be addressed in the empirical sense.

Theory and Practice Compared: Results

In the spirit of a chart essay approach (Jones & Mitchell, 1990), results of this study are presented for each of the seven research questions. Each question is stated and followed by a

brief discussion of the theoretical issues it represents, the answers to the particular question based on the information obtained from the 23 cases of mixed method triangulation in nursing science, and a brief discussion of the results and corresponding implications per question. In the summary section, information across questions and cases is briefly summarized.

1. What kinds of rationales are given for selecting sets of methods with counteracting bias?

Issues. Convergence as "truth" or as more valid findings seems to be justified in theory when sets of different methods with counteracting biases are implemented in a way that preserves their error and allows for compensation of that error. Thus, when methods are very different in terms of their sources, directions and magnitudes of associated error, convergence may be indicative of validity or trustworthiness of constructs, findings or interpretations. When methods tend to be similar in regard to error, convergence may simply imply that the methods are interchangeable or reliable with regard to one another. Whether methods are similar or different in regard to bias, there is also the possibility that convergence could be the result of compounded bias or error. Considering that the theoretical meaning of the results of mixed method triangulation depends upon the degree to which the methods are different in regard to their sources, magnitudes and directions of error, it seems important to select a set of methods for a mixed method triangulation

design in a very strategic way. Of interest here is how researchers identify the hypothetical bias associated with individual methods and how researchers construct sets of methods that possess counteracting bias.

Results and implications. Researchers in eight of the twenty-three studies (35%) stated rationales for the selection of their sets of quantitative and qualitative methods. In all but one case, rationales seemed a priori in nature. That is to say that the justification of the method set seemed to precede the implementation of the methods and the interpretation of the results. In one case, the rationale was developed post hoc in the sense that the convergent results were used to support the selection of methods. Three kinds of rationales for selecting sets of methods emerged from the data: substantive, methodological and logistical.

Substantive rationales were based on an analysis of the substantive or informational strengths and weaknesses of different methods rather than on an analysis of the hypothetical methodological biases associated with each method. Glik, Parker and Muligande (1987, p.182) provide an example of a substantive rationale:

> "Kroeger states that research which uses anthropological approaches tends to yield information about health decision-making processes as well as an understanding of the disease/illness experience within

> a specific cultural context. Yet this approach may not link that information to overall health care utilization patterns. On the other hand, epidemiological surveys may yield information about disease prevalence, utilization rates, and access to care factors, but may not account for biases and assumptions implicit in Western constructs of disease and illness or take into account the contexts in which health care decisions are made."

Six researchers created substantive rationales for selecting sets of methods. In all cases, the purpose of substantive rationales seemed to be to show how different methods would generate different kinds of information in order to yield a more comprehensive picture of the entity of investigation as a result of combining methods. This search for substantive diversity and complementarity seems inappropriate in the context of triangulation which seeks the sameness of information from different methods.

Methodological rationales involved an analysis of the methodological strengths and weaknesses of different methods in terms of potential bias and error rather than in terms of substantive possibilities. Methodological rationales were stated in six cases. In all six cases, the purpose was to show how the methodological weaknesses of one method were compensated for by the methodological strengths of another method. Hinds and Young

(1986, p. 196) provide an example of a rationale that contains primarily methodological reasons for selecting their specific combination of methods:

> "The methods were viewed as compensatory, as the limitations of one were offset by the strengths of another. For example, archival records were used to counterbalance the reactive influence an investigator's presence could have on a participant's self report data. Observation data, which can be contaminated by observer bias, were compared with or checked against a participant's questionnaire and interview responses. Field notes were used to expand and explain quantified questionnaire responses. Open ended interview questions offset the predetermined, defined, and limited foci of the questionnaires. The purposeful selection of these data collection methods reflected the assumption that every method is subject to certain validity threats .... In essence, the selected methods were assessed as having dissimilar biases and therefore were thought to diminish the systematic effects of participant and investigator based errors associated with any single method."

Logistical rationales involve an analysis of the logistical strengths and weaknesses associated with a set of methods. Glik et al. (1987, p. 182) provided the only example of a logistical rationale for method selection:

> "... Large scale in-depth surveys or classical anthropological field work approaches are costly and time consuming, and because of this, they are often not feasible tools for health education planning. An alternative approach is to use multiple methods of data collection, which can maximize the validity of data to be collected in the field and minimize the cost, by allowing a smaller sampling frame for in-depth phases of research."

While time and money were indicated as logistical concerns in this rationale, it is conceivable that political concerns may also be important in the selection of sets of methods.

Summary. Thirty-five percent of the researchers cited rationales for method set selection. These researchers created three kinds of rationales: substantive, methodological and logistical. Examples of these three kinds of rationales may provide guidance to other researchers concerned with justifying the selection of their methods. One area for future research is the association of different rationales with different purposes and contexts for mixed method research. For instance, it may be that substantive rationales are more likely to be found in

situations where (a) the primary mixed method purpose has to do with substantive comprehensiveness rather than with methodological triangulation, (b) mixed method triangulation is used as a strategy rather than as an overall purpose of the mixed method study, and (c) mixed method triangulation is emergent rather than preplanned.

Sixty-five percent of the researchers did not cite reasons for believing that the set of methods they used did in fact possess counteracting bias. Several issues seem worth investigating. First, it may be wrong to assume that researchers who did not include rationales for method selection in their reports did not have rationales. Restraints imposed in the publication process may have restricted the incorporation of rationales into reports. Other reasons may have precluded the inclusion of a description of the rationales for method selection.

Second, the lack of rationales brings to question whether the creation of rationales for method selection is viewed by researchers as an important design feature of mixed method triangulation. If it is not, perhaps researchers are unaware of the implications associated with the heterogeneity of irrelevancy assumption. Perhaps researchers have found it impossible to specify hypothetical strengths and weaknesses of different methods or perhaps they are disregarding the idea that bias or error can cancel out in a mixed method design. Or, perhaps they

are responding to a conception of triangulation that does not depend on the heterogeneity of irrelevancy assumption. Interviews would be very helpful for revealing the perception or conception of mixed method triangulation from the researcher's point of view.

2. To what extent are the hypothetical biases of methods preserved by implementing different methods independently?

Issues. The preservation of inherent biases in individual methods is a prerequisite condition for assuming that bias in the overall design has been canceled out. By enacting independent implementation of methods, researchers may infer in theory that they have preserved the counteracting biases associated with the different methods (Campbell & Fiske, 1959; Greene et al., 1989; McClintock & Greene, 1985). Independent implementation refers to the process of conceptualizing, designing and implementing methods independently (Greene et al., 1989).

Theoretically, independent implementation affects how one can interpret the results of mixed method triangulation. If different methods are implemented independently, the results of triangulation may be interpreted in light of the assumption that bias has been canceled out. If bias is assumed to be canceled out, convergence may indicate more valid findings (Campbell & Fiske, 1959) and nonconvergence may provoke a substantive reconceptualization. However, if methods are not implemented

independently, researchers may have a more difficult time assuming that bias has been canceled out, and the results of triangulation may therefore be more equivocal.

Results and implications. The notion of independent implementation was not addressed directly in any of the cases of mixed method triangulation in nursing science. It was difficult to determine whether methods were implemented independently or interactively in seven cases (31%). In fifteen cases (65%), methods seemed to be implemented interactively. In the majority of cases, one researcher seemed to have designed, implemented and analyzed both qualitative and quantitative methods.

In only one case (4%) was it obvious that methods were implemented independently. In a case by Fagan (1988), different people implemented different methods to assess the same phenomenon, peripheral perfusion. Perhaps independent implementation was feasible because there were multiple researchers.

There may be several explanations for the lack of independence in implementation of methods. First, researchers may not be clear about what independent implementation means in operational terms. Or, independent implementation in operational terms may not be easy to obtain, especially in a situation where only one researcher is conducting a study. Second, researchers may be rejecting the theoretical importance of independent implementation or at least not recognizing it as important in

their work. Third, other design features may be more important to researchers in designing mixed method triangulation. By interviewing researchers, these other more important features might be specified.

A side issue for future investigation is the idea that independent implementation was not addressed in any of the cases regardless of whether triangulation was planned or emergent. It seems logical that independent implementation might not be feasible in cases where triangulation is emergent because it would be difficult to plan ahead for all possible cases of triangulation in an emergent design. However, it is somewhat more confusing to find that independent implementation is not addressed in planned triangulation where it is possible to set up conditions ahead of time that would affect the interpretation of results.

Summary. Independent implementation of methods is not addressed or enacted by most researchers conducting mixed method triangulation in nursing science. In one case where independent implementation was utilized, different researchers implemented the different methods. Further research is needed to determine why the issue of independence is not addressed.

3. Are researchers assuring that different methods are focused on the same entity of investigation by implementing methods simultaneously or by establishing the stability of the entity of investigation over time?

Issues. A distinguishing feature of triangulation is that one entity is being investigated. In triangulation, different methods are focused on the one entity of investigation with the hope that the results or findings of different methods will agree. While there is no defacto way of knowing if methods are actually focused on the same entity, researchers may increase the theoretical likelihood that methods are focused on the same entity if the methods are implemented simultaneously (Greene et al., 1989; McClintock & Greene, 1985) or if researchers can establish that the entity of investigation is stable over time (Greene et al., 1989). In either case, it seems that researchers need to have some assurance that different methods are not focused on different aspects of a changing entity or on different entities. Theoretically, if methods are focused on different entities, convergence might represent an accumulation of error and nonconvergence might represent a picture of "truth".

Results and implications. The notion of simultaneous implementation or stability of the investigative entity was not addressed directly in any of the cases of mixed method triangulation in nursing science. In three cases (13%), it was possible to determine that methods were not implemented simultaneously. In nineteen cases (83%), it was difficult to determine whether or not methods were implemented simultaneously. The notion of the stability of an entity of investigation over time was not addressed by researchers in any of the cases.

In one case (4%) by Fagan (1988), the methods were obviously implemented simultaneously. This is the same case in which independent implementation of methods was noted. In this situation several people implemented different methods simultaneously and independently. When the results of the different methods converged on the same diagnosis, the primary researcher justified the reliability of her methods and the validity of the diagnosis.

In spite of the lacking evidence for simultaneous implementation or stability of entities, several researchers did address the issue of whether or not methods were focused on the same entity. Aroian & Patsdaughter (1989) stated that scores, verbal self-reports, clinical assessments and cultural-environmental assessments were all directed at the phenomenon of psychological distress. O'Brien (1990) stated that a standardized scale and focus interviews both revealed patient compliance behavior. Perhaps the researchers in these two situations were implying that the entities of investigation were stable over time. If this were true, methods might not need to be implemented simultaneously to insure that the same entity was being measured by all methods.

Hinds and Young (1987) obtained positive significant correlations between quantified content analyzed concepts from interviews and scores from self-report questionnaires. They used these correlations to support their theoretical contention that

qualitative methods and quantitative methods were "indexing the same construct (i.e., wellness)" (p. 197). They also used these correlations as evidence of convergence and validity of findings.

The use of correlations for both purposes is interesting. According to theory, it seems that researchers might first want to establish that methods are focused on the same entity before comparing the results of the different methods to determine if convergence has occurred. To use the correlations as evidence of one entity of investigation and of the convergence of results is one possibility. To use the correlations as evidence of convergence in a situation where it has been established through some other means that one entity of investigation is being pursued is another possibility.

Summary. Simultaneous implementation and stability of constructs were not addressed directly by nursing science researchers in their written cases of mixed method triangulation. In the one case where simultaneous implementation was utilized, several researchers were available to actually implement the different methods simultaneously. It might be that multiple researchers are needed to implement methods simultaneously and independently. Simultaneous and independent implementation of methods may not be practical in situations where mixed method triangulation is conducted by one researcher. This issue has been discussed by McClintock and Greene (1985). Further research is needed to determine the feasibility of simultaneous and

independent implementation in practice, the meaning of simultaneous and independent implementation to researchers, and ways to establish that one construct is being investigated by all methods.

4. What reasons or evidence are given by researchers for believing that questions asked by different methods and information obtained by different methods are comparable?

Issues. In mixed method triangulation, qualitative and quantitative methods and information are combined within one study. Rossman and Wilson (1985) refer to qualitative methods as those that "... usually generate data not easily reduced to numbers ..." (p. 628) and quantitative methods as those "... to which the power of mathematical analysis can be applied easily" (p. 628). Similarly, Greene et al. (1989) define "... mixed method designs as those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm" (p. 256). An issue for mixed method triangulation is whether the qualitative and quantitative methods being used are responding to the same questions and whether the information obtained from qualitative and quantitative methods can be compared.

Results and implications. In eighteen of the cases (79%), researchers did not address the issue of comparability of questions or information. In four cases (17%), researchers

addressed the issue indirectly: (a) Jones, Strom and Daniels (1989) indicated that structured interviews had been designed to assess the content validity of the Parental Strengths and Needs Inventory in the deaf culture. The authors implied that the interview questions corresponded to the topics covered on the inventory. (b) Hildman (1987) stated that a telephone interview was designed to match the information requested in a mail survey. The interview and survey were made available to readers, but an analysis of the comparability of questions or data was not made explicit. (c) Similarly, Rowatt (1983) stated that scales and interviews addressed similar questions. She, too, made the protocols available in the appendix without an analysis of the comparability of questions or information. (d) Fagan (1988) was a little more direct in that she offered some explanation of how different methods were assessing different indicators of the same entity of investigation, shock.

Hinds and Young (1987) were the only authors to deal directly with the comparability of questions and information. Their investigation provides a good example of a preplanned triangulation study. Hinds and Young (1987) identified the specific informational areas associated with each method and then planned triangulation strategies in areas where they hypothesized that methods tapped the same information. While the authors did

not construct a matrix to show the informational cross over among and between methods, such a matrix could easily be constructed based on their discussion.

Summary. Seventy-nine percent of the researchers did not address the comparability of questions or information associated with different methods. Perhaps researchers are taking comparability for granted. Perhaps comparability is not an issue to researchers. Or perhaps researchers are not sure how to demonstrate comparability. Hinds and Young (1987) provide a good model for researchers to follow in addressing the comparability of questions and information related to different methods.

5. How do researchers justify the expectation of convergence as more valid findings and determine its existence?

Issues. The theoretical notion of triangulation rests on the ideas that irrelevant error associated with individual methods can be canceled out and that what is left is more valid findings. The emphasis on the potential benefits of "triangulating on truth" seems to set the detection of convergence as a desirable and dominant goal of mixed method triangulation (Mathison, 1988).

As Mathison (1988) notes, this emphasis on convergence may promote the complacent acceptance of convergence as "truth". Researchers may "see" what they expect to see ... which is convergence. In this regard, convergence may be more of a state of mind (Mathison, personal communication, 1990) rather than an

empirical entity, and this state of mind might undermine the skepticism that seems so crucial to meaningful research.

Empirically, convergent results may be indicative of something other than more valid findings. According to Shotland and Mark (1987, p. 91), convergence may actually be "pseudoconvergence", an agreement or convergence that does not represent accurate or valid data, findings or interpretations. Theoretically, pseudoconvergence can occur as a result of several factors: (1) a constant source of substantive or methodological error operating across methods (Cook, 1985), (2) a constant direction of substantive or methodological error operating across methods (Cook, 1985) or (3) a set of independent methods investigating different questions, processes or variables (Shotland & Mark, 1987). Thus, convergence may actually be an accumulation of error rather than an accumulation of "truth". It seems reasonable to ask how researchers determine and justify that convergence is not something other than "truth".

Results and implications. Three themes emerged from the data in regard to the ways in which researchers justified the expectation of convergence. In two cases (9%) by Erickson (1988) and Hinds and Young (1987), researchers justified their expectation of convergence as more valid findings based on the hypothesis that they had selected sets of methods that possessed counteracting biases (i.e., methodological justification). It is interesting to note that these researchers did not include

simultaneous and independent implementation in their justifications for expecting convergence. In most cases (61%), researchers did not address the expectation of convergence before interpreting the results of their studies (i.e., nonexistent justification). In seven cases (30%), researchers seemed to imply that convergence was expected based on the expressed but not generally explained hypothesis that different methods were focused on the same entity of investigation (i.e., substantive justification).

In nursing science, convergence seemed to be defined as a "consistency across findings". Consistency of findings seemed to be used as evidence of valid convergence: "Where the results of applying different methods reinforce each other, it is not unreasonable to assume they are valid" (Pearson, Durant & Punton, 1989). Validity seemed to be equated with consistency, and researchers seemed more concerned with demonstrating consistency than with justifying the expectation of convergence as more valid results.

Two themes emerged from the data in regard to the ways in which researchers demonstrated consistency across findings. One theme seemed more quantitative in nature. It involved the quantification of qualitative results and the subsequent analysis of the "quantified qualitative data" and the raw quantitative data through the use of correlations or percentages. Significant positive correlations of as low as .26 were used as evidence of

convergence. Researchers did not address the rules of evidence they consider in determining which correlations and percentages supported convergence and which did not.

The second theme seemed more cognitive or perhaps more qualitative in nature. It involved the demonstration of a conceptual congruence between information obtained from the different methods. Researchers seemed to be most concerned with comparing substantive themes obtained from qualitative and quantitative analyses. An example of this pattern is indicated by a quote: "All adolescents verbally validated the direction of change in hopefulness indexed by the HSA score" (Hinds, 1989, p. 446). The determination of convergence seemed most likely to occur at the level of meta-analysis, after both qualitative and quantitative results had been analyzed and interpreted separately.

Summary. While some researchers supported their expectation of convergence, they did not make a case for convergence as more valid findings based on the theoretical directives of independent and simultaneous implementation. The lacking attention to theoretical directives in determining convergence and in ruling out pseudoconvergence, and the possible equating of consistency and validity lends support to Mathison's (1988) fear that there is complacent acceptance of convergence as "truth" in practice. However, researchers in nursing science did not refer to

convergence as "truth". Rather, they seemed to perceive convergence as evidence of substantive issues worthy of discussion in informational rather than methodological terms.

6. What kinds of outcomes do actually result from attempts at mixed method triangulation?

Issues. In the literature, convergent information is cited as the most important outcome of mixed method triangulation. Repetitive information, whether it is referred to as convergence (Campbell & Fiske, 1959; Cook, 1985), consistency, corroboration (Rossman & Wilson, 1985; 1991), or triangulation (Denzin, 1970, 1978; Webb et al., 1966) is sometimes epitomized as an ultimate goal of social science research. Wimsatt in Kaplan (1964, p. 140) has referred to convergence as a "criterion of reality." Similarly, Cook (1985, p.48) refers to "points of convergence" as potential "sources of light."

As indicated by Mathison (1988), the emphasis placed on obtaining convergence in mixed method triangulation may result in the failure to realize or acknowledge other benefits of mixed method triangulation (i.e., inconsistency of results that do not support a single proposition and contradiction of results that provoke new questions or explanations) (p. 15). Furthermore, Greene, Caracelli and Graham (1989), have identified five purposes or kinds of mixing methods in practice, only one of which involves "triangulation", or the use of different methods focused on one entity of investigation for the purpose of

obtaining similar results. Greene et al.'s (1989) other purposes and outcomes of mixing methods include the complementarity and expansion of methods and results to gain a more comprehensive understanding of an entity, the development of methodology through the use of mutually informing methods, and the provocation and discovery of new information and questions as a result of contradiction. Because there is concern that other purposes may be overlooked or considered secondary as a result of the emphasis on convergence, it seems reasonable to look at the actual outcomes of mixed method triangulation.

Results and implications. Outcomes in mixed method triangulation in nursing science seem to occur at two levels. First level outcomes consist of the interpretation of results generated from the different methods individually. Second level outcomes consist of the interpretation of results from the combination of the first level outcomes. For the purposes of this discussion, second level outcomes will be referred to as meta-outcomes.

Four different kinds of meta-outcomes emerged from the cases of mixed method triangulation in nursing science: repetitive, elaborative, contradictory and synergistic. These meta-outcomes are consistent with the purposes and outcomes of mixed method research identified by Rossman and Wilson (1985, 1991) and Greene, Caracelli and Graham (1989). The emergence of different

meta-outcomes in mixed method triangulation in nursing science may be evidence that researchers are not restricting the role of triangulation to the production of convergence.

In mixed method triangulation in nursing science, repetitive meta-outcomes are characterized by a consistency of information across different methods. The identification of repetitive meta-outcomes in mixed method research in nursing science supports the theoretical contention that repetitive information in mixed method triangulation practice is sought and obtained. Repetitive meta-outcomes were the most frequently cited outcomes of mixed method triangulation in nursing science. However, repetitive meta-outcomes were not the only outcomes reported by researchers. Thus, there may be evidence to refute the hypothesis that convergence dominates thinking and practice to the exclusion of other meta-outcomes that appear in practice.

An example of repetitive meta-outcomes in nursing science follows. Hinds and Young (1987) investigated the kinds of personal wellness goals that patients set and achieved through the use of numeric scores on a self-report Likert questionnaire, themes generated from interpretive reports of meetings between patients and nurses, and content analysis results from verbal responses to open ended interview questions. They compared first level outcomes from scores, themes and categories and found consistency across inferences drawn from the results of different methods. The consistency across inferences constitutes a

repetitive meta-outcome in Hinds and Young's investigation. Repetitive meta-outcomes are representative of Rossman and Wilson's (1985) corroboration of findings and of Greene et al.'s (1989) "... convergence, corroboration, correspondence of results .." (p. 259).

Elaborative meta-outcomes in nursing science are those that seem to result in a more comprehensive understanding of an entity of investigation. While the intent in triangulation seems to be to obtain repetitive meta-outcomes, researchers obtained elaborative outcomes when methods revealed different sorts of substantive information than that which was expected in the original triangulation design. The fact that elaborative meta-outcomes emerge in triangulation studies brings into question the ability of researchers to predict the substantive targets of different methods.

An example of elaborative meta-outcomes follows: Giles, Bradbard and Endsley (1987) used triangulation strategies to investigate the impact of child life interns on children and adults in a community hospital. Time sampling and participant observation were used to answer the same research questions: (1) Where are the children? (2) What are the children doing? (3) Who is with the children? (4) What are the parents and children doing? The two methods did provide repetitive or convergent information regarding the research questions.

However, as the investigation progressed, it became evident that in addition to providing the same information, each method provided new information about the entity of investigation that the other method did not provide. While both methods provided information about "what" was going on, time sampling revealed "how often" things were occurring and participant observation provided information about "how, why and in what context" things were happening. Although repetitive information was sought through the use of mixed method triangulation, elaborative meta-outcomes were also obtained. In elaborative meta-outcomes, differences in methods seemed to produce different but more comprehensive and complementary information. Elaborative meta-outcomes seem representative of Rossman and Wilson's (1985) elaboration of findings and the desired outcomes of Greene et al.'s (1989) complementarity and expansion purposes.

Contradictory meta-outcomes seemed to occur when information generated by different methods was incongruent. Contradictory meta-outcomes may be perceived as the opposite of repetitive outcomes in the sense that a comparison of the information obtained from different methods focused on the same entity reveals oppositional findings where similar findings were expected. Contradictory meta-outcomes seem representative of the concept of nonconvergence (Campbell & Fiske, 1959; Cook, 1985; Mark & Shotland, 1987).

An example of a contradictory meta-outcome follows. Glik (1986) investigated health care behavior of Rwandese mothers. The results of a deductive, structured survey indicated that 42% of the mothers took their children to a health care clinic when the children had fevers and that 38% gave their children oral rehydration salts (ORS) when the children had diarrhea. In a focus group, all (100%) mothers reported taking children with fevers to a health clinic and all (100%) mothers said they had used ORS and found it to be beneficial. Percentages from the survey and percentages from the focus group constitute first level outcomes. The discrepancies in the percentages across methods are examples of nonconvergence and constitute contradictory meta-outcomes.

The last type of meta-outcome observed in mixed method triangulation in nursing science is a synergistic meta-outcome. A synergistic meta-outcome is marked by its newness. It is a 'whole that is greater than the sum of its parts'. It is what Greene et al. (1989) and Rossman & Wilson (1985) refer to as "initiation". An example follows.

In a study of bereavement related to the Mount Saint Helens eruption (Murphy, 1988), a combination of first level outcomes from structured interviews and standardized instruments led to the reconceptualization of the process of "recovery" in relation to victims of the volcanic eruption. Instead of returning to conditions as they were before, it became evident that people's

lives were "forever changed." The process of recovery was reconceptualized as a process of adaptation where in people reported progress in terms of adjustment rather than recovery in terms of returning to past conditions.

With synergistic meta-outcomes, different methods produce new and different information. In nursing science, these included (a) new questions, (b) new solutions and (c) new understandings. In several cases, synergistic meta-outcomes allowed researchers to see errors in previous conceptualizations or instrumentation. Synergistic meta-outcomes seemed to be the result of contradictory as well as elaborative meta-outcomes.

Summary. While repetitive meta-outcomes seem to be the intended outcomes of mixed method triangulation in nursing science, researchers did obtain other meaningful meta-outcomes: elaboration, contradiction and synergy. Based on results from nursing science, triangulation can be perceived as a vehicle for more than the production of convergent findings. Future research may involve a comparison of the value of convergent, elaborative, contradictory and synergistic meta-outcomes from the perspective of mixed method researchers. It may be that synergistic reconceptualizations rather than convergence are the most valued meta-outcomes of mixed method triangulation.

7. How is nonconvergence resolved?

Issues. While convergence seems to be the desired result of mixed method triangulation, nonconvergence may occur. Shotland and Mark (1987, p. 91) discuss several theoretical explanations for nonconvergence: (a) methods that address different parts of an entity of investigation, (b) methods that measure different parts of an entity of investigation, (c) methods that tap different intensities of an entity of investigation, and (d) methods that have different degrees of error that is not counteracted in the research process. Cook (1985) notes that nonconvergence presents a researcher with a puzzle to be solved. It may be that when independent methods have been employed and focused on the same entity and when convergence is expected that nonconvergence may be most likely to yield very significant substantive meaning. However, an emphasis on methodological explanations for nonconvergence may inhibit the development of substantive explanations.

Results and implications. Researchers did acknowledge nonconvergent results and demonstrated different approaches to dealing with the contradictory meta-outcomes. One researcher reported the contradictory results but did not discuss any potential resolutions. Some researchers offered methodological reasons to explain the contradiction. For example, in the case where Glik et al. (1986) obtained discrepancies in percentages across methods, they resolved the discrepancy by attributing the

higher percentages obtained from the focus group interviews to the tendency of participants to want to please researchers by giving what they perceived as the correct or desired responses. Methodological explanations for nonconvergence given by other researchers included: lacking sensitivity or inappropriateness of scales, insufficient sample size for statistical significance, reactivity bias and testing effect, poor design, high mortality rate and methods focused on different entities.

Some researchers offered substantive reasons for nonconvergence. For example, Aroian and Patsdaughter (1989) combined several different aspects and dimensions of psychological distress in Polish immigrants: participants' self ratings on the Brief Symptom Inventory (BSI), participants' verbal self-reports of the migration and resettlement experience, participant observation of social interactions, and clinical assessment of mental status. Individual scores and group means on the psychoticism subscale of the BSI inventory, were high. The scores were indicative of withdrawal, isolation, thought disorder, and schizoid life-style.

Observations and verbal reports seemed to support the psychoticism scores. For instance, observations of interaction indicated a high degree of interpersonal distance and verbal reports of social relationships indicated that people questioned the authenticity of social relationships. However, clinical assessments did not indicate signs of thought disorder or

schizophrenia. Through interviews it was determined that the Polish participants did not trust or socialize much because of a cultural response to Communist control rather than because they were psychotic as indicated on the BSI. The incongruence of information was resolved substantively.

For others seeking substantive resolutions, nonconvergence acted as a springboard to new conceptualizations or synergistic meta-outcomes. And others approached the task of resolving nonconvergence by developing a series of plausible rival hypotheses and then constructing arguments to support or refute each hypothesis. Examples of this latter strategy are evident in studies by Hinds and Young (1987), Erickson (1988) and Rowatt (1983).

Summary. Nonconvergent findings were cited 10 times in mixed method triangulation studies in nursing science. Thus, there is evidence that researchers are not necessarily overlooking the divergent findings that they obtain. In addition, researchers seemed to reinforce Cook's (1985) idea that divergent results offer an opportunity for problem solving. Both methodological and substantive explanations were given to resolve the contradictory results. Substantive explanations were offered more frequently than methodological explanations, thereby contradicting the notion that methodological explanations inhibit the development of substantive explanations.

Theory and Practice Compared: Summary

Results of this investigation indicate that researchers in nursing science did not necessarily apply the theoretical directives of the heterogeneity of irrelevancy assumption to their practice of mixed method triangulation. Researchers did not discuss the heterogeneity of irrelevancy assumption in their work. As a group, nursing science researchers did not employ independent or simultaneous implementation of different methods. They did not usually construct technical or methodological justifications of convergence as more valid findings. Instead, researchers seemed to focus their attention on substantive or informational issues rather than on technical or methodological issues.

The lack of attention given to theoretical implications of the heterogeneity of irrelevancy assumption by nursing science researchers may be explained in several different ways. First, researchers may not be aware of the theoretical implications of the heterogeneity of irrelevancy assumption for mixed method triangulation. Second, researchers may be aware of the theoretical implications and consider a counteraction of bias to be robust to violations. Third, researchers may find that it is not feasible to actualize the theoretical implications in practice. Fourth, researchers may feel that the conventional theory based on the heterogeneity of irrelevancy assumption has

little to do with the conception of triangulation that they actualize in practice. These four hypotheses may provide the foci for future investigations.

Results of this investigation suggest that researchers in nursing science are practicing a conception of triangulation that is driven by substantive rather than methodological/technical concerns. Nursing science researchers tended to construct substantively-based justifications for designs and for interpretations of results. This is in contrast to the formulation of more technical features on which the conventional conception of triangulation seems to rest. Yet, this situation does seem consistent with Barone's (1990) idea that when research is guided by substantive considerations, methodological issues fall into place.

These results suggest that the heterogeneity of irrelevancy assumption may not be a useful guideline for some practitioners of mixed method triangulation in nursing science. Examples from the practice of mixed method triangulation in nursing science may provide data-based guidelines for researchers who are trying to (a) construct rationales for method selection, (b) resolve divergent results and (c) realize multiple meta-outcomes from triangulation. More research is needed to develop an alternative conception of mixed method triangulation that is grounded in the perspectives of researchers conducting mixed method triangulation.

Appendix A: Mixed Method Purposes (Greene et al., 1989)

1. "TRIANGULATION seeks convergence, corroboration, correspondence of results from the different methods" (Greene et al., 1989, p. 259).

2. "COMPLEMENTARITY seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from the other method" (Greene et al., 1989, p. 259).

3. "DEVELOPMENT seeks to use the results from one method to help develop or inform the other method, where development is broadly construed to include sampling and implementation, as well as measurement decisions" (Greene et al., 1989, p. 259).

4. "INITIATION seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from the other method" (Greene et al., 1989, p. 259).

5. "EXPANSION seeks to extend the breadth and range of inquiry by using different methods for different inquiry components" (Greene et al., 1989, p. 259).

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